Application No. 09/889,860
Filed: July 23, 2001
TC Art Unit: 1733
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THE CLAIMS

1. (Currently Amended) A method of manufacturing a bowl of thermostructural composite material formed by fiber reinforcement densified by a matrix, the method comprising:

making a bowl preform by winding a yarn, the preform having an axial passage through its bottom;

densifying the bowl preform by chemical vapor infiltration; ~~and~~

closing the passage by means of a plug made of thermostructural composite material; and

performing a final chemical vapor infiltration step after the passage has been closed by the plug, the final chemical vapor infiltration step comprising forming a ceramic matrix phase.

2. (Original) A method according to claim 1, characterized in that a consolidated bowl preform is made prior to chemical vapor infiltration.

3. (Previously Presented) A method according to claim 1, characterized in that the consolidated bowl preform is made by winding a yarn impregnated by a precursor for said material constituting the matrix, and by transforming the precursor by heat treatment.

4. (Previously Presented) A method according to claim 3, characterized in that the consolidated bowl preform is made by winding a yarn impregnated by a carbon precursor and by transforming the precursor.

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5. (Previously Presented) A method according to claim 4, characterized in that the carbon precursor is selected from furan, epoxy, and polyimide resins.

6. (Previously Presented) A method according to claim 3, characterized in that two consolidated preforms are made simultaneously by winding a shape on a mandrel where the shape corresponds to that of two bowl outline portions joined rim-to-rim, and by cutting the resulting winding in its middle portion.

7. (Previously Presented) A method according to claim 1, characterized in that the bowl preform is made from yarn that has no surface treatment to provide surface functions.

8. (Previously Presented) A method according to claim 1, characterized in that the bowl preform is made from a carbon yarn.

9. (Previously Presented) A method according to claim 1, characterized in that the bowl is subjected to high temperature purification and stabilization treatment.

10. (Currently Amended) A method according to claim ~~1~~ 9, characterized in that the high temperature purification and stabilization treatment is performed on ~~the~~ a consolidated bowl preform.

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11. (Previously Presented) A method according to claim 9, characterized in that the purification and stabilization treatment is performed at a temperature greater than 2200°C.

12. (Previously Presented) A method according to claim 1, characterized in that bowl preform densification is performed by forming a carbon matrix.

13. (Currently Amended) A method of manufacturing a bowl of thermostructural composite material formed by fiber reinforcement densified by a matrix, the method comprising:

making a bowl preform by winding a yarn, the preform having an axial passage through its bottom, the axial passage having a rim;

densifying the bowl preform by chemical vapor infiltration; and

closing the passage by means of a plug made of thermostructural composite material, characterized in that the plug has a lip having a shape matching a shape of the rim of the axial passage to interfit with the axial passage and is made in two pieces that are assembled together so as to clamp onto the rim of the axial passage in the preform.

14. (Cancelled)

15. (Cancelled)

16. (Cancelled)

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17. (Currently Amended) A method according to claim ~~16~~ 1, characterized in that the ceramic matrix phase is made of silicon carbide.

18. (Previously Presented) A method according to claim 1, characterized in that a protective coating is formed at least on the inside face of the bowl.

19. (Original) A method according to claim 18, characterized in that a protective coating is made out of pyrolytic carbon.

20. (Original) A method according to claim 18, characterized in that a protective coating is made out of silicon carbide.

21. (Previously Presented) A method according to claim 1, characterized in that the inside face of the bowl is provided with a protective layer.

22. (Original) A method according to claim 21, characterized in that the protective layer is made of a thermostructural composite material.

23. (Previously Presented) A method according to claim 22, characterized in that a plurality of consolidated bowl preforms is densified simultaneously by chemical vapor infiltration.

24. (Currently Amended) A method according to claim 2, characterized in that:

the consolidated bowl preform is made by winding a yarn impregnated by a carbon precursor selected from phenolic, furan, epoxy, and polyimide resins for said material constituting the matrix, and by transforming the precursor by heat treatment;

two consolidated preforms are made simultaneously by winding a shape on a mandrel where the shape corresponds to that of two bowl outline portions joined rim-to-rim, and by cutting the resulting winding in its middle portion;

the bowl preform is made from yarn that has no surface treatment to provide surface functions;

the bowl preform is made from a carbon yarn;

the bowl is subjected to high temperature purification and stabilization treatment;

the high temperature purification and stabilization treatment is performed on the consolidated bowl preform;

the purification and stabilization treatment is performed at a temperature greater than 2200°C;

bowl preform densification is performed by forming a carbon matrix;

the plug is made in two pieces that are assembled together so as to clamp onto the rim of the axial passage in the preform;

the passage is closed by a plug made of thermostructural composite material;

~~it includes a step consisting in performing a final chemical vapor infiltration step after the passage has been closed by the plug;~~

~~the final chemical vapor infiltration step comprises forming a ceramic matrix phase;~~

the ceramic matrix phase is made of silicon carbide;

a protective coating is formed at least on the inside face of the bowl;

a protective coating is made out of pyrolytic carbon or silicon carbide;

the inside face of the bowl is provided with a protective layer;

the protective layer is made of a thermostructural composite material; and

a plurality of consolidated bowl preforms is densified simultaneously by chemical vapor infiltration.

25. (Previously Presented) A method according to claim 4, characterized in that the carbon precursor comprises a phenolic resin.

26. (Previously Presented) A method according to claim 1, wherein, in the step of densifying the bowl preform by chemical vapor infiltration, resistance of the densified bowl preform to corrosion by silicon oxide is increased.

27. (Currently Amended) A method according to claim ~~15~~ 1, wherein, in the step of performing ~~a~~ the final chemical vapor infiltration, resistance of the bowl preform to corrosion by silicon oxide is increased.

28. (New) A method according to claim 13, characterized in that a consolidated bowl preform is made prior to chemical vapor infiltration.

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29. (New) A method according to claim 13, characterized in that the consolidated bowl preform is made by winding a yarn impregnated by a precursor for said material constituting the matrix, and by transforming the precursor by heat treatment.

30. (New) A method according to claim 29, characterized in that the consolidated bowl preform is made by winding a yarn impregnated by a carbon precursor and by transforming the precursor.

31. (New) A method according to claim 30, characterized in that the carbon precursor is selected from furan, epoxy, and polyimide resins.

32. (New) A method according to claim 29, characterized in that two consolidated preforms are made simultaneously by winding a shape on a mandrel where the shape corresponds to that of two bowl outline portions joined rim-to-rim, and by cutting the resulting winding in its middle portion.

33. (New) A method according to claim 13, characterized in that the bowl preform is made from yarn that has no surface treatment to provide surface functions.

34. (New) A method according to claim 13, characterized in that the bowl preform is made from a carbon yarn.

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35. (New) A method according to claim 13, characterized in that the bowl is subjected to high temperature purification and stabilization treatment.

36. (New) A method according to claim 35, characterized in that the high temperature purification and stabilization treatment is performed on the consolidated bowl preform.

37. (New) A method according to claim 35, characterized in that the purification and stabilization treatment is performed at a temperature greater than 2200°C.

38. (New) A method according to claim 13, characterized in that bowl preform densification is performed by forming a carbon matrix.

39. (New) A method according to claim 13, characterized in that it includes a step consisting in performing a final chemical vapor infiltration step after the passage has been closed by the plug.

40. (New) A method according to claim 39, characterized in that the final chemical vapor infiltration step comprises forming a ceramic matrix phase.

41. (New) A method according to claim 40, characterized in that the ceramic matrix phase is made of silicon carbide.

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42. (New) A method according to claim 13, characterized in that a protective coating is formed at least on the inside face of the bowl.

43. (New) A method according to claim 42, characterized in that the protective coating is made out of pyrolytic carbon.

44. (New) A method according to claim 42, characterized in that the protective coating is made out of silicon carbide.

45. (New) A method according to claim 13, characterized in that the inside face of the bowl is provided with a protective layer.

46. (New) A method according to claim 45, characterized in that the protective layer is made of a thermostructural composite material.

47. (New) A method according to claim 46, characterized in that a plurality of consolidated bowl preforms is densified simultaneously by chemical vapor infiltration.

48. (New) A method according to claim 28, characterized in that:

the consolidated bowl preform is made by winding a yarn impregnated by a carbon precursor selected from phenolic, furan, epoxy, and polyimide resins for said material constituting the matrix, and by transforming the precursor by heat treatment;

two consolidated preforms are made simultaneously by winding a shape on a mandrel where the shape corresponds to that of two

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bowl outline portions joined rim-to-rim, and by cutting the resulting winding in its middle portion;

the bowl preform is made from yarn that has no surface treatment to provide surface functions;

the bowl preform is made from a carbon yarn;

the bowl is subjected to high temperature purification and stabilization treatment;

the high temperature purification and stabilization treatment is performed on the consolidated bowl preform;

the purification and stabilization treatment is performed at a temperature greater than 2200°C;

bowl preform densification is performed by forming a carbon matrix;

it includes a step consisting in performing a final chemical vapor infiltration step after the passage has been closed by the plug;

the final chemical vapor infiltration step comprises forming a ceramic matrix phase;

the ceramic matrix phase is made of silicon carbide;

a protective coating is formed at least on the inside face of the bowl;

the protective coating is made out of pyrolytic carbon or silicon carbide;

the inside face of the bowl is provided with a protective layer;

the protective layer is made of a thermostructural composite material; and

a plurality of consolidated bowl preforms is densified simultaneously by chemical vapor infiltration.

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49. (New) A method according to claim 30, characterized in that the carbon precursor comprises a phenolic resin.

50. (New) A method according to claim 13, wherein, in the step of densifying the bowl preform by chemical vapor infiltration, resistance of the densified bowl preform to corrosion by silicon oxide is increased.

51. (New) A method according to claim 39, wherein, in the step of performing the final chemical vapor infiltration, resistance of the bowl preform to corrosion by silicon oxide is increased.

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